Mini-drift Results
Fine Strip Chevron Analysis: X-ray Scan

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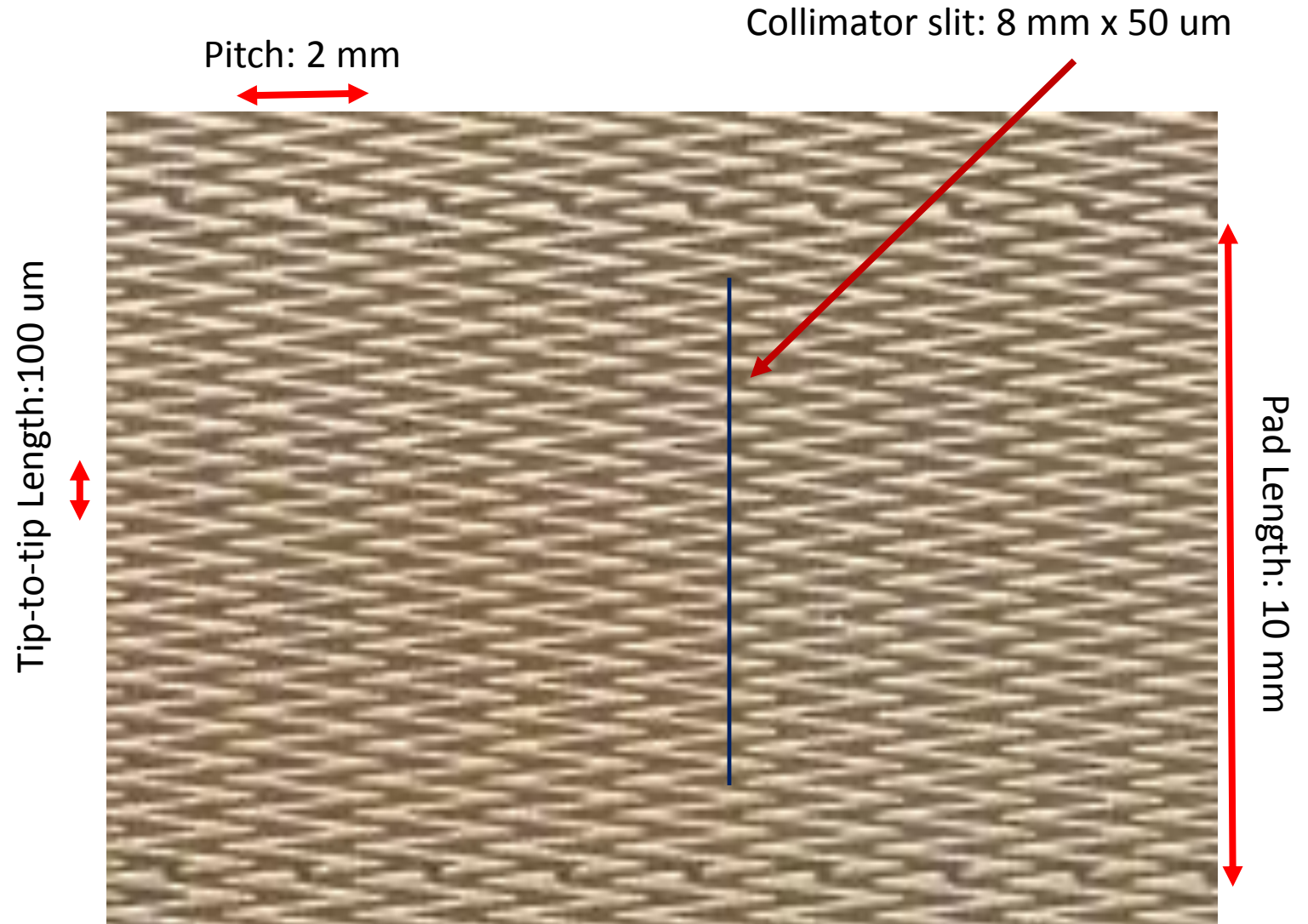
X-ray scan of mini-drift GEM (chevron readout)

Goal:
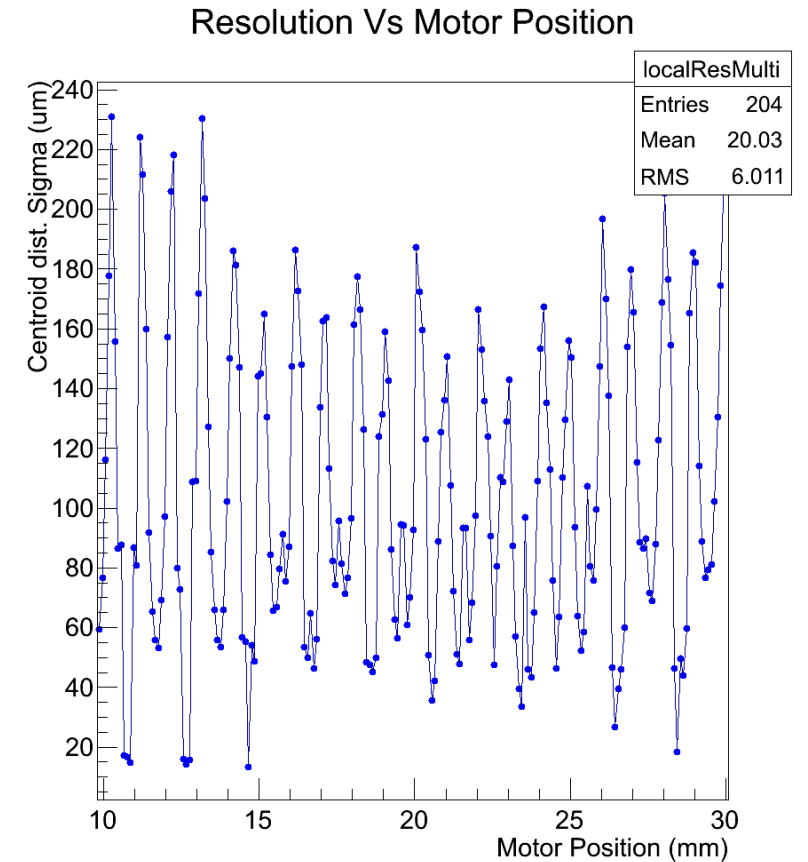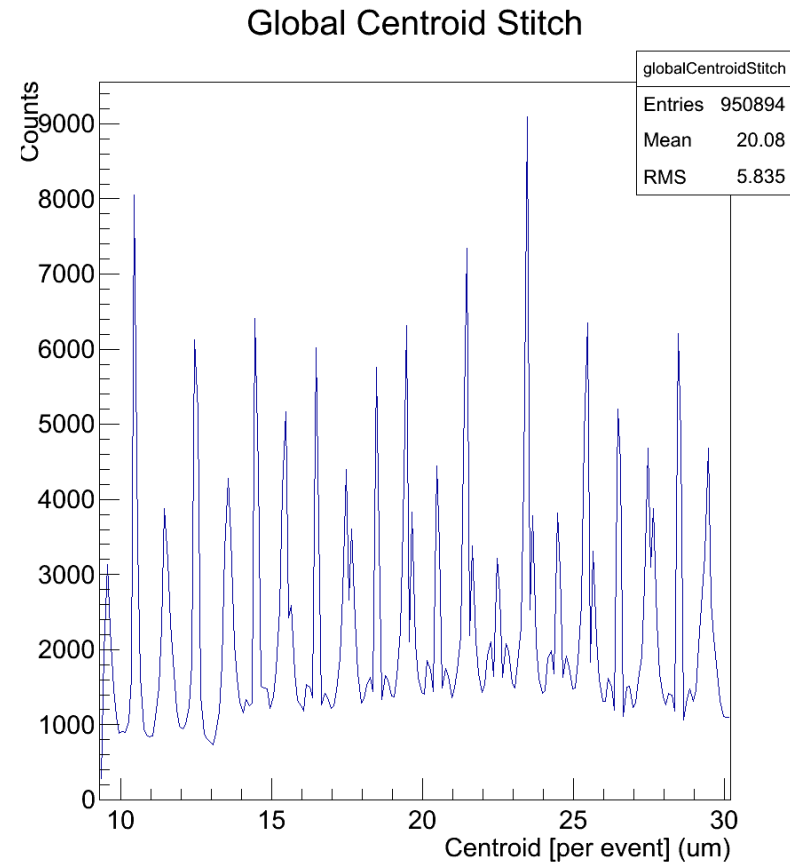- Study performance and resolution as function of position across chevron pads

Method:
- Attach collimated X-ray gun to motor
- Scan across chevrons (left-to right in this picture) taking 5,000 events in 100 um increments
- Use the motor position of the x-ray gun as reference point
- Motor centered in the middle of one pad and run over the width of 10 chevron pads
- *NOTE*: The positional error from the width of the collimator and the spread of the x-ray conversion must be deconvolved to find true resolution
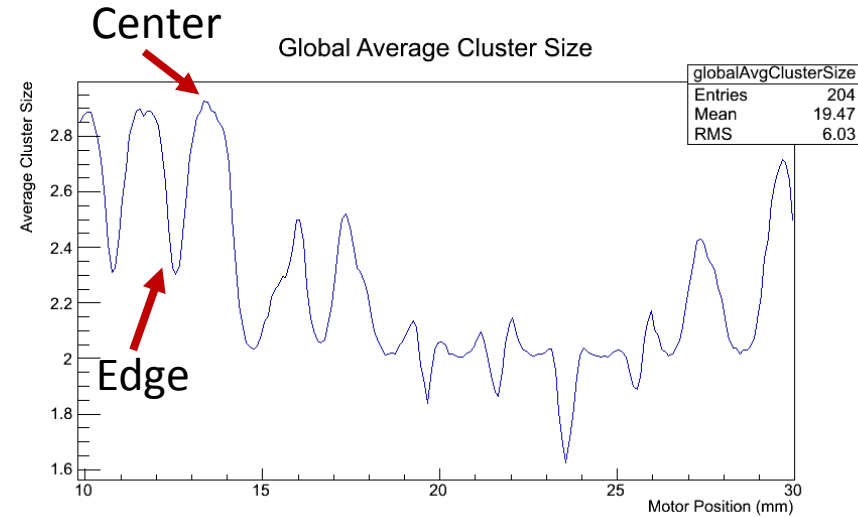
Pitch: 2 mm

Collimator slit: 8 mm x 50 um

Tip-to-tip Length:100 um

Pad Length: 10 mm
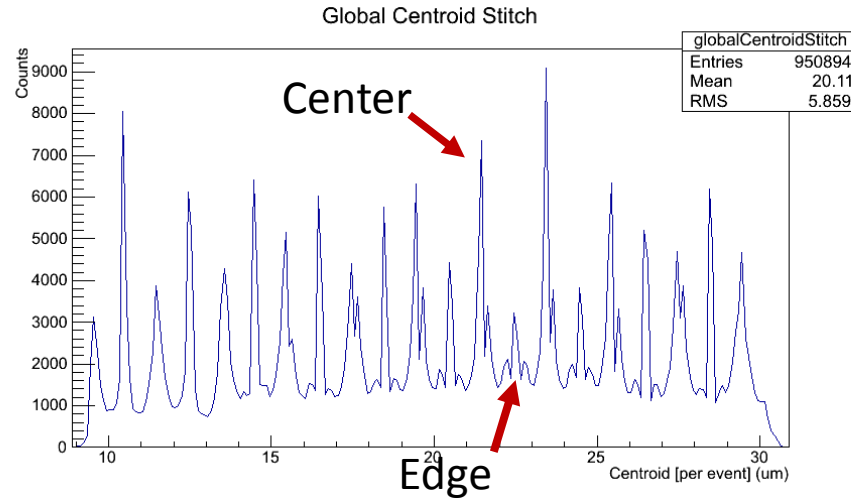
Resolution as function of position

- 5,000 events taken in 100 um steps over 204 different motor positions
- Left hand plot: Shows centroid distribution of all events after cuts (~1/2 the total events)
- Right hand plot: Resolution at each motor position
- To find total resolution: shift each centroid distribution by motor position

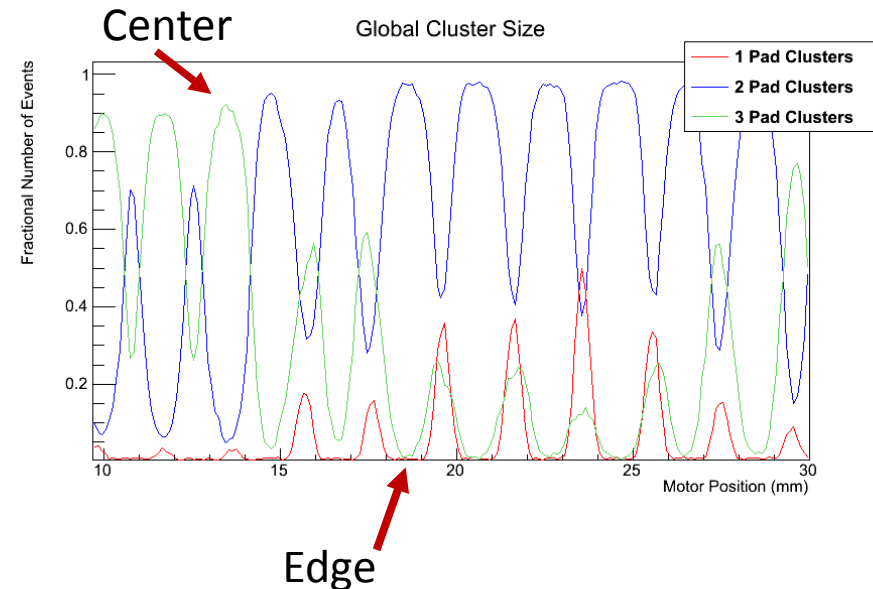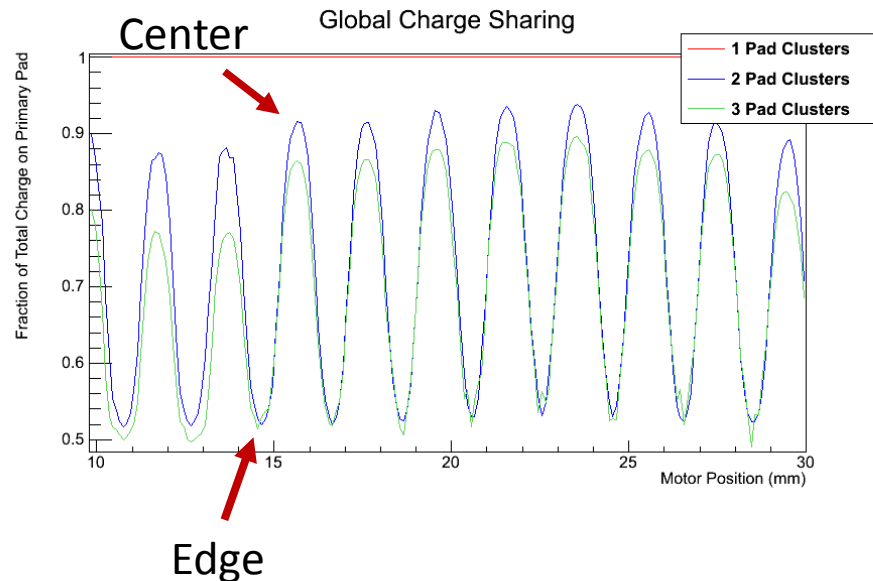# Cluster size/Charge sharing across chevrons

1) Center and edge of chevron appear as periodic spikes in centroid distribution

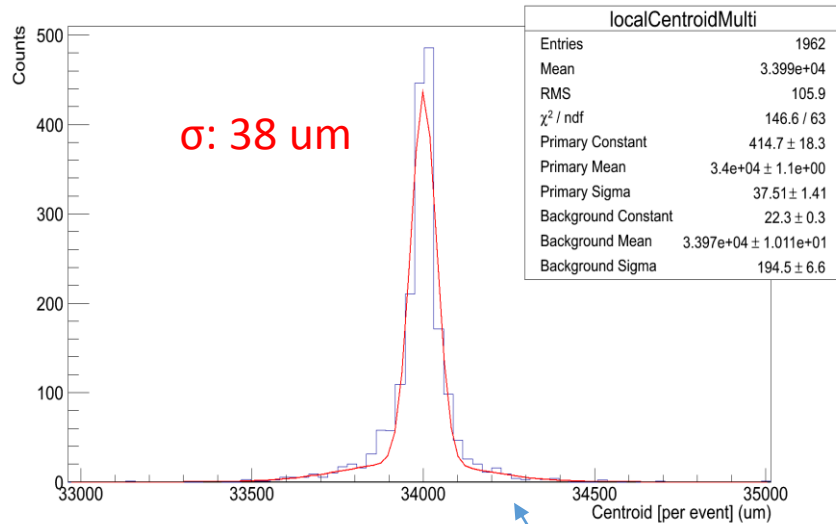2) Some variation in cluster size due to edge effects on board

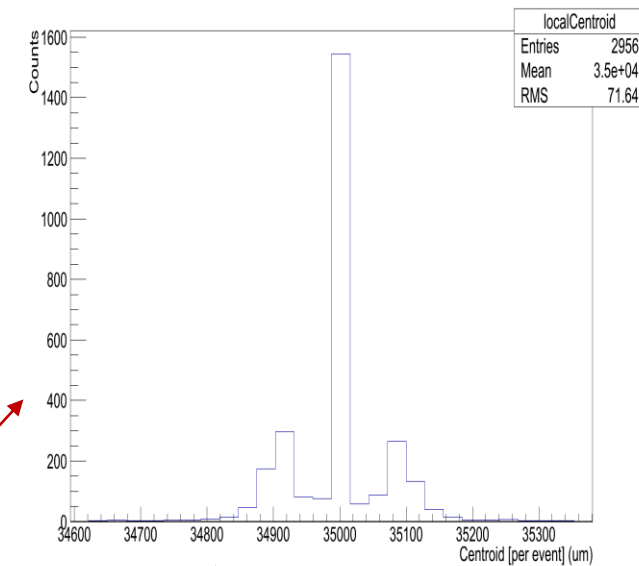3) Best charge sharing: Edge of chevron

Worst: Center of chevron

4) Charge sharing not function of only cluster size. Can have 3 pad clusters with poor charge sharing

Centroid Structure

Local Centroid Multi Pad

σ: 38 um

localCentroidMulti	
Entries	1962
Mean	3.399e+04
RMS	105.9
χ² / ndf	146.6 / 63
Primary Constant	414.7 ± 18.3
Primary Mean	3.4e+04 ± 1.1e+00
Primary Sigma	37.51 ± 1.41
Background Constant	22.3 ± 0.3
Background Mean	3.397e+04 ± 1.011e+01
Background Sigma	194.5 ± 6.6

Local Centroid

localCentroid	
Entries	2956
Mean	3.5e+04
RMS	71.64

Global Centroid Stitch

globalCentroidStitch	
Entries	950894
Mean	3.4e+04
RMS	921.7

Global Cluster Size

- 1 Pad Clusters
- 2 Pad Clusters
- 3 Pad Clusters

2) Edge of chevron
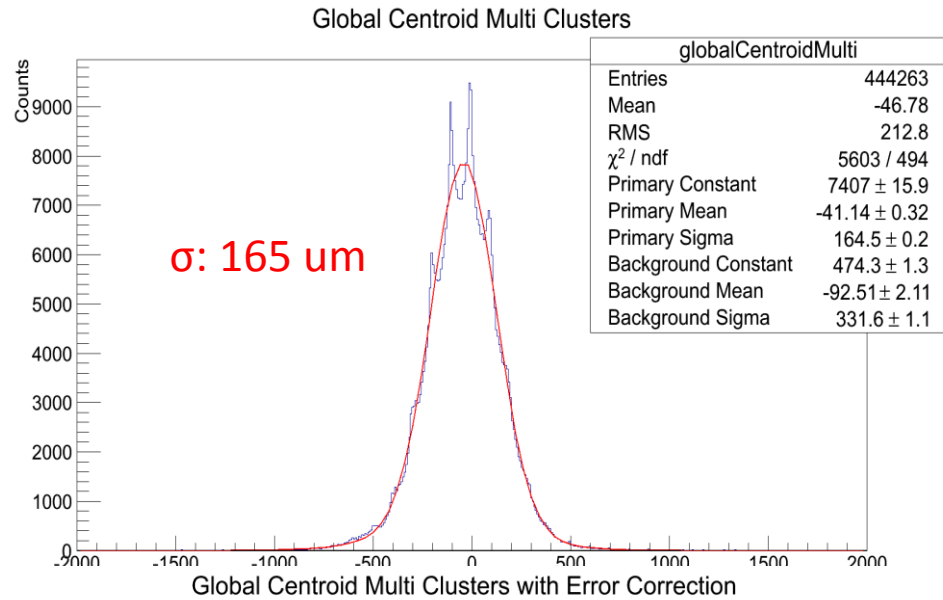- Primarily 2 pad events with good charge sharing
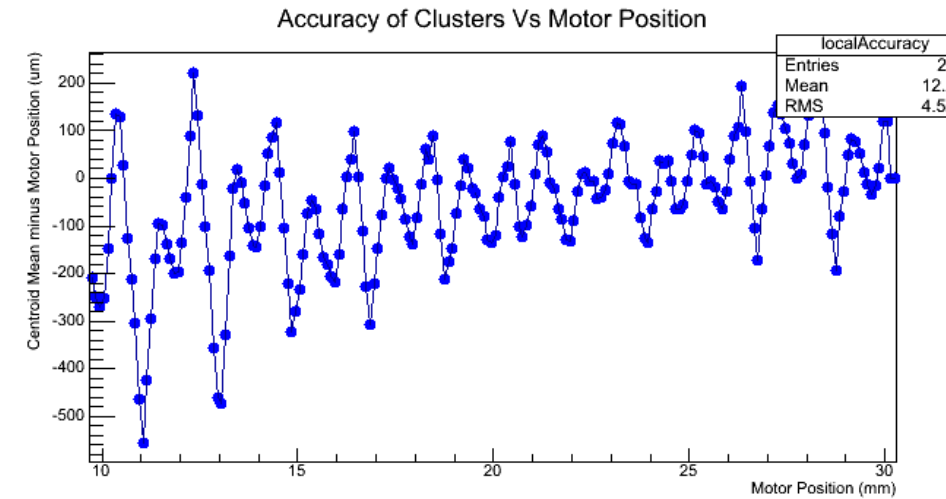- Very precise tracking

2) Center of chevron
- Middle peak from single pad events.
- Shadow from poor charge sharing 2 pad events
- Two outer peaks from poor charge sharing 3 pad events

Global resolution and Error plots before/after corrections for multi-pad events
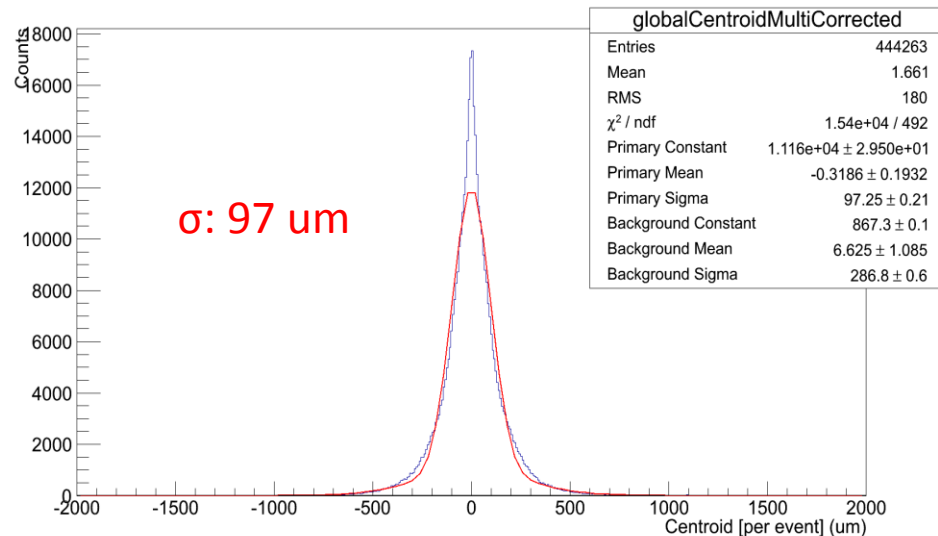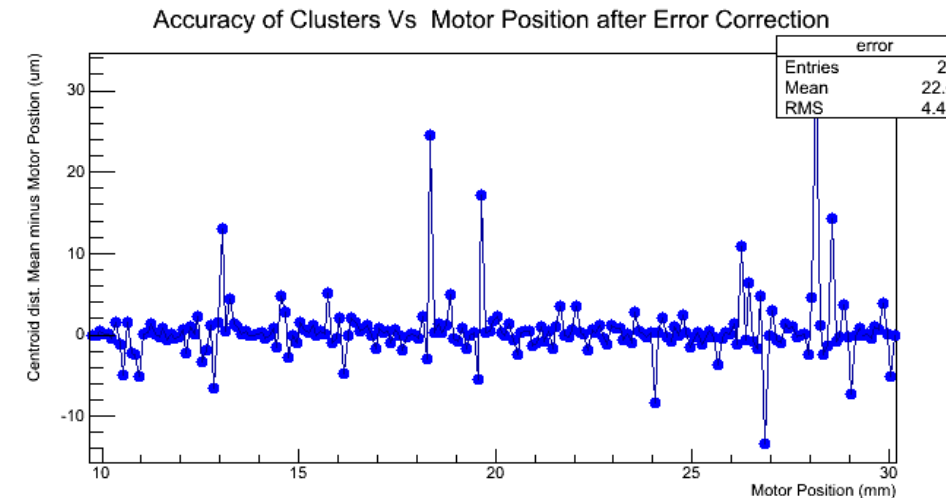
1) Global centroid before error corrections

Global Centroid Multi Clusters

globalCentroidMulti	
Entries	444263
Mean	-46.78
RMS	212.8
χ² / ndf	5603 / 494
Primary Constant	7407 ± 15.9
Primary Mean	-41.14 ± 0.32
Primary Sigma	164.5 ± 0.2
Background Constant	474.3 ± 1.3
Background Mean	-92.51 ± 2.11
Background Sigma	331.6 ± 1.1

σ: 165 um

2) Error at each motor position subtracted from centroids

Accuracy of Clusters Vs Motor Position

localAccuracy	
Entries	2
Mean	12.
RMS	4.5

3) Global centroid after error corrections: Not final result yet

Global Centroid Multi Clusters with Error Correction

globalCentroidMultiCorrected	
Entries	444263
Mean	1.661
RMS	180
χ² / ndf	1.54e+04 / 492
Primary Constant	1.116e+04 ± 2.950e+01
Primary Mean	-0.3186 ± 0.1932
Primary Sigma	97.25 ± 0.21
Background Constant	867.3 ± 0.1
Background Mean	6.625 ± 1.085
Background Sigma	286.8 ± 0.6

σ: 97 um

4) Leftover error: remnant of histogram binning

Accuracy of Clusters Vs Motor Position after Error Correction

error	
Entries	2
Mean	22.
RMS	4.4

What's Next

- Deconvolve positional error of x-ray source from resolution of the detector
- Use error function from beam test data for in-lab data (and vice versa). Same board in both tests, so we expect similar error functions